

SSD vs HDD - “Picking the Ideal Drive for You”

Computers need a system to store, retrieve, and share data. Solid State Drives (SSDs), and Hard Disk Drives (HDDs) are storage devices in computers. But they differ in technology, performance, durability, costs, and many more aspects.

What is an SSD?

Solid State Drives are advanced storage devices using interconnected flash memory chips to store data. SSD drive is a larger version of a flash drive that is mounted inside the computer or server.

SSDs made their appearance in laptops in the late 2000s, and have since come in various form factors. This includes the 2.5-inch form factor used in Laptops, and the 3.5-inch format used in Desktop Computers. SSDs have also increased in capacity, and are now commonly used in both laptops, and desktop computers.



Fig 1 : Solid State Drive

Fig 1 refers to the interior of an SSD drive. There are large black semiconductors mounted to the circuit board. This is where the data is electronically stored.

Below are some of the key features of SSDs.

- SSDs use non-volatile memory chips to retain data even when the power is turned off.
- Memory chips are organized into blocks, and further into pages, allowing for faster read, and write operations.
- Data transfer is fast due to the absence of moving components.
- SSDs are more resistant to physical shocks, and less prone to mechanical failure.
- They have quicker boot times, faster application launches, and overall better system performance.

- SSDs may use different types of NAND flash memory. These include Single-Level Cell (SLC), Multi-Level Cell (MLC), Triple-Level Cell (TLC), or Quad-Level Cell (QLC). Each type has different levels of performance, durability, and cost.
- In the server side, SSDs offers faster read/write times, boosting server speed by around 95%. This speeds up page loading time, encouraging developers to add more features to web applications.

Many computers, and tablets are now equipped with already installed SSD instead of traditional hard drive. Though SSDs are expensive than HDDs, but their better performance and increasing affordability have made them popular.

Do SSDs have any downside?

SSDs have a finite number of writes available, which may require replacing the SSD drive in the future. Hence they are less reliable for long term storage. They can also lose effectiveness as they approach their maximum terabytes written (TBW). Drives with degraded blocks or pages may arrive from the factory. This can lead to faster breakdowns and early drive failure.

What is a HDD?

HDDs are conventional non-volatile storage devices connected to computers or servers. Fig 2 refers to the inside of an HDD.



Fig 2 : Hard Disk Drive

Below are some of the key features of HDDs.

- HDDs store information on a series of magnetic spinning platters.
- Read/write heads mounted on an actuator arm moves across the spinning disks to read these platters.
- A controller board manages these operations, and coordinates the head movement.
- An interface (SATA or older versions like PATA) connects the HDD to the computer.
- HDDs boast a long-established technology. They are widely compatible with a broad range of devices, including older systems and various hardware configurations.
- HDDs offer high-capacity storage, ideal for applications like server farms, data centers, and archival storage.
- In certain cases of failure, data recovery from a failed HDD is more straightforward, and affordable due to its mechanical nature.

Difference between HDDs and SSDs

Parameters	SSD	HDD
Technology	Uses NAND flash memory chips	Uses mechanical parts like spinning platters, and head to access data
Storage Capacity	Available maximum size is up to 100TB, though most commonly used size is 120 GB to 512 GB	Available up to 20 TB
Speed	Sequential read/write speeds can vary from several hundred MB/s to over 3,000 MB/s, depending on the SSD type and technology	Sequential read/write speeds typically range between 80-160 MB/s.
Durability	More durable due to the absence of moving parts	Less durable due to the wearing out of moving parts with time
Reliability	Failure rate of less than 0.5 %	Failure rate fluctuates between 2 % to 5 %
Noise and Heat	Very low	Audible mechanical noise due to spinning disks, and moving head
Weight	Lighter than HDD	Heavier than SDD
Energy Consumption	Consume between 2 & 5 Watts	Consume between 6 & 15 Watts
Latency	Shorter	Higher
Size	Compact	Large
Data Transfer	Random	Sequential
Cost	Expensive	Affordable

Finally which one to choose?

Go for SSD

1. You need speed, and have sufficient budget.
2. Do not intend to store data for an extended time.

Go for HDD

1. You have a limited budget.
2. Can negotiate on the speed.
3. Intend to store data for a long time.

While SSDs have made significant advancements in performance and durability, HDDs continue to serve as reliable, and cost-effective storage solutions. This is specially beneficial for applications requiring vast amounts of storage capacity at a lower cost.

Is it possible to go for both SSD and HDD

Combination of both SSD and HDD creates balance between speed and storage capacity at an affordable price. Here are scenarios when having both can be helpful.

1. **Performance and Storage Allocation:** SSDs boast exceptional speed, making them ideal for storing the operating system, frequently used software, and games. This translates to swift boot times, rapid application launches, and seamless gaming sessions. In contrast, HDDs are better equipped for housing large files like videos, photos, and documents due to their ample storage capacity. They shine in scenarios where speed takes a backseat to storing vast amounts of data.
2. **Cost-effectiveness:** Opting for SSDs for tasks requiring high performance and HDDs for storing large amounts of data offers a cost-effective strategy. This avoids the premium cost linked to exclusively using large SSDs for all storage requirements. SSDs typically come at a higher cost per gigabyte compared to HDDs. Integrating both types allows one to optimize performance without exceeding their budget.
3. **Customization:** Opting for SSDs for tasks requiring high performance, and HDDs for storing large amounts of data offers a cost-effective strategy. This avoids the premium cost linked to exclusively using large SSDs for all storage requirements. SSDs typically come at a higher cost per gigabyte compared to HDDs. Integrating both types allows one to optimize performance without exceeding their budget.
4. **Graphics or processing video:** SSD drives provide a critical time-savings in the overall conversion time of that data. If analyzing significant amounts of information, SSDs offer a drastic reduction in processing time and server load, enabling no lag video streaming.
5. **Gaming or Media Editing:** SSDs' speed is beneficial to Gamers or professionals working with large media files . It helps the user to load games faster or faster rendering. User also utilize the HDD's larger space for game libraries or media archives (Fig 3). Additionally HDD can be used to store data access less frequently.

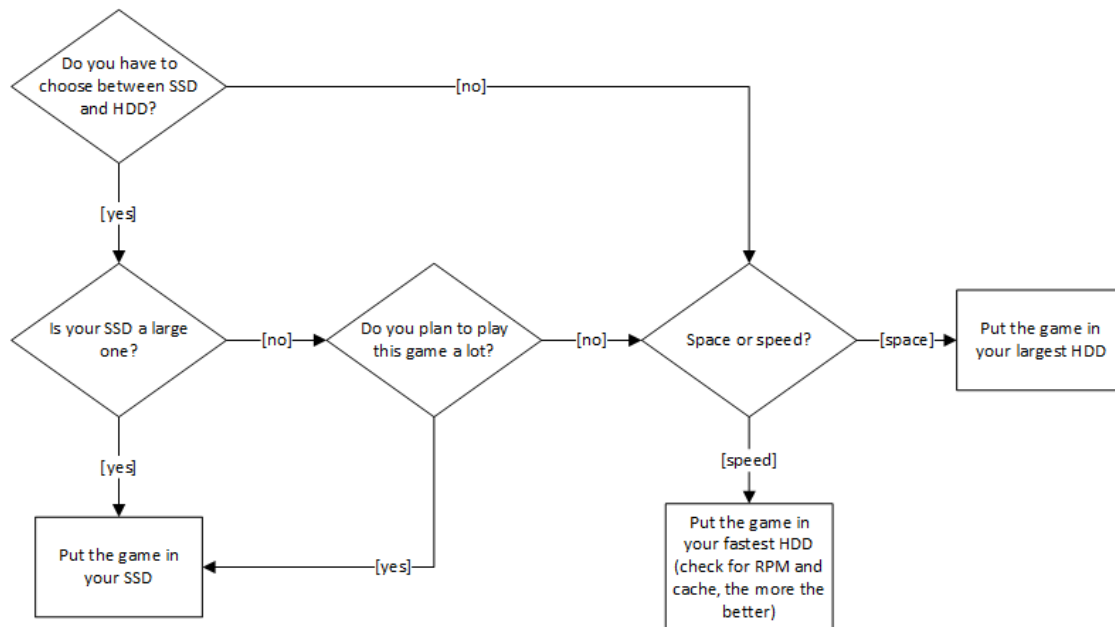


Fig 3 : A Sample Flowchart to decide between SSD and HDD for storing Gaming application

Conclusion

In business servers, it is common to use both SSDs and HDDs together for better performance. But in personal servers, HDDs alone might be enough for storing files. In conclusion, whether it is for business or personal servers, combining SSDs and HDDs offers the best of both speed, and storage space. This allows users to customize their systems according to own needs, and affordability.

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